## Claims

Sub. A1

1. A method for laser processing a multi-layered target including at least two layers having different chemical compositions with respective first and second optical absorption characteristics responsive to ultraviolet light, comprising:

generating high power ultraviolet laser output pulses having a predetermined spatial spot size a wavelength shorter than about 400 nm, a temporal pulse width shorter than about 100 ns, and an average output power of greater than about 100 mW measured over the spatial spot size; and

applying the laser pulses to the target so that the pulses cleanly remove at least two layers within the spatial spot size.

2. The method of claim 1 in which the layers comprise any combination of at least two of the following chemical compositions: organic dielectric material, reinforcement material, or metal or combination of metals.

Sub. A2

3. The method of claim 2 in which the organic dielectric material is selected from PTFE, polyimides, epoxies, BT, phenolics, cyanate esters, paper, cardboard, or combinations thereof; the reinforcement material is selected from glass, aramid fibers, Kevlar TM, ceramics, or combinations thereof; and the metal is selected from aluminum, titanium, nickel, copper, tungsten, platinum, gold, molybdenum, palladium, silver, or combinations thereof.

5 ~~4~~. The method of claim 1 in which the wavelength of the laser output pulses is within a range of about 180-400 nm.

6 ~~5~~. The method of claim 1 in which the target ~~structure~~ comprises at least three layers having different chemical compositions and optical absorption

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characteristics, and the laser output pulses sequentially remove all three layers.

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7 ~~6~~. The method of claim 1 in which the spatial spot size is less than about 50 μm across its surface diameter.

Sub a3

8 ~~7~~. The method of claim 1 in which the several pulses are employed to remove a target area greater than 25 μm.

9 ~~8~~. The method of claim 1 in which the laser output is generated by a solid-state laser.

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12 ~~9~~. The method of claim 1 in which the ~~target~~ layers have a combined depth of greater than 25 μm.

10. The method of claim 9 ~~8~~ in which the solid-state laser is selected from the group of Nd:YAG, Nd:YLF, Nd:YAP, and Nd:$YVO_4$.

11. The method of claim 9 ~~8~~ in which the laser comprises YAG doped with holmium or erbium.

12. The method of claim 1 in which the pulses are generated at a repetition rate of greater than about 1 kHz.

Sub a4

13. A method of increasing the saturation depth of cut per pulse in a target material as a function of increasing power density of a laser beam pulse striking the target material to cause a depthwise removal of target material within a spatial region thereof, comprising:

producing high-power ultraviolet light output pulses generated by a solid-state laser, the light output pulses having a power density per pulse and a spot area that is smaller than the spatial region of the target material; and

directing the light output pulses sequentially to multiple positions associated with the spatial region to remove multiple amounts of target material corresponding to the spot area and with minimal depth of cut per pulse saturation to a depth corresponding to the power density per pulse of the light output pulses.



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14. The method of claim 13 in which the target material is of a multi-layer type having a combined thickness of at least two layers of material having different chemical compositions with respective different absorption characteristics in response to ultraviolet light.

14 ~~15.~~ The method of claim 13 in which the spatial region has a periphery and the multiple positions to which the ~~light~~ laser output pulses are directed define a contiguous set of spot areas along the periphery of the spatial region to remove the target material within the spatial region and thereby produce a hole through the target material.

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15 ~~16.~~ The method of claim 13 in which the spatial region has a periphery and a central portion and in which the multiple positions to which the ~~light~~ laser output pulses are directed define a contiguous set of spot areas extending outwardly from the central portion along a path to the periphery of the spatial region to remove the target material from the spatial region and thereby produce a blind via in the target material.

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16 ~~17.~~ The method of claim ~~16~~ 15 in which the path is generally of spiral shape.

18. The method of claim 14 in which the layers comprise any combination of at least two of the following chemical compositions: organic dielectric material, reinforcement material, or metal or combination of metals.

19. The method of claim 18 in which the organic dielectric material is selected from PTFE, polyimides, epoxies, BT, phenolics, cyanate esters, paper, cardboard, or combinations thereof; the reinforcement material is selected from glass, aramid fibers, Kevlar TM, ceramics, or combinations thereof; and the metal is selected from aluminum, titanium, nickel, copper, tungsten, platinum, gold, molybdenum, palladium, silver, or combinations thereof.



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20. The method of claim 13 in which the light output pulses have a predetermined wavelength shorter than about 400 $\mu m$, a temporal pulse width shorter than about 100 ns, an average output power of greater than about 100 mW measured over the spot area, and a repetition rate of greater than about 1 kHz.

21. The method of claim 13 in which the spatial spot area is less than about 50 $\mu m$ in diameter.

Sub. a5

22. The method of claim 1 in which each pulse cleanly removes at least two layers within the spatial spot size.

add a6

Add B3

Add C3